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No. 8

# *The* CHEMIST

NOVEMBER-DECEMBER, 1934

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*Publication of The AMERICAN INSTITUTE of CHEMISTS*

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## *In This Issue*

John A. Steffens

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Florence E. Wall

♦ ♦ ♦

Symposium Niagara Chapter

♦ ♦ ♦

Institute Notes



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$\text{NO}_3$	.001%
PO <sub>4</sub>	.0005%
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Fe	.0005%
H.M. (as Pb)	.0005%

### $\text{NH}_4\text{NO}_3$

MAXIMUM LIMITS OF IMPURITIES	
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Nonvolatile	.010%
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White (as $\text{NO}_2$ )	.0005%
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# The CHEMIST

Publication of

THE AMERICAN INSTITUTE OF CHEMISTS, INC.

ALAN PORTER LEE, F.A.I.C., *Editor*, 233 Broadway, New York City

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1. Free alkali and free fat existing together consult Devine's Method, J. Am. Chem. Soc., Vol. 22, P. 493 (1900)
2. Hoyt-Pemberton, J. Ind. Eng. Chem. Vol. 14, P. 94 (1922)
3. Wolff Method Bur. Stds. Bull. 129

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C. P. CHEMICALS AND ACIDS

## Specialization and Changed Conditions

By John A. Steffens, F.A.I.C.

In order to gain the greatest economic benefit in times of keen competition, the technician must be adaptable to work in broader fields than those afforded by intensive specialization.

**D**URING the war, including the years before our entry, graduating classes in schools were given inspiring talks on the duty and privilege of going into chemical plants and building up our chemical industry. The speakers appealed to the basic urge of creative activity, giving students the needed recognition then and there. They were marching as to war. What a fine feeling of importance they felt! Plenty of work, plenty of jobs, even though the pay wasn't much. The speakers did well, too. They propagandized the country, until all students with an I.Q. of normal or better, took technical courses. The mills of the schools ground fast and exceedingly large. They sent the students down the canyon of narrow and specialized training in an ever-swelling stream, trusting that jobs would be at the other end.

Last year, a young friend and chemist, over a year after graduation, returned from a visit to an employment agency and hilariously told that he had had a fine class reunion. All but two of his class had been there and those two had jobs with their parents. No work, no jobs, no use for their training. This represents a lapse of time of about twenty years, but most occupations have a similar story to tell. The situation may be accepted as without significance, or some inferences may be drawn.

Following history, we observe after the last war a redirection of social activity, and the trend continues toward internal social development. With these changes still taking place, we may compare them to the effects of a geological revolution, during which the old world changes, new continents and mountains are lifted, glaciers spread, and volcanoes spurt. The science of paleontology shows that, under such conditions, life takes on new forms, and those forms survive which are least specialized to a given environment. The adaptable type can meet the new conditions. Without unduly exaggerating the picture, we may

extend this generalization to the occupations. Narrow specialization is not conducive to survival, but adaptability is.

The schools are shaping themselves to this end, under the impact of a series of developments in psychology and psychiatry. Integrated personalities, responding to the stimuli of worth-while tasks with self-conceived plans and with freedom for accomplishment are mentally healthy. Tasks which promise security, activity, and recognition call forth vigorous response and cooperation. Restraint develops a spontaneous reaction toward achieving freedom. These, and similar observations are the result of the descriptive stage of the study. More changes may be expected as psychology accumulates experimental findings and is able to produce practical results that the schools and the professions may use. It behooves us to keep in touch with these changes despite our specializations. Already the engineer steps from one field to another. The mechanical or civil engineer may take on chemical engineering functions, or go even further into business and politics. A kind of citizen is in the making who will be able to draw on all stores of knowledge, applying the facts thus gathered to the performance of one task after another; a broadly competent person, adequately expert in the task at hand, capable of working in cooperation with other people.

IT is difficult to estimate the effects of such social discoveries as are in the making. More change is due, but no one, even the Marxist, can envision it. The spread of scientific knowledge through the population heeds not the thunder of dictator or theologian, yet the entire social structure will be bent by it. Some obvious facts may not even be mentioned. Who may openly write about the underlying motives in the drive of individuals for the power that lies in those pieces of paper called property rights and their associated sanctified immoralities? To turn such sod requires strong tools, and happily, we may leave its turning to time and change. The obsession of one generation is forgotten by the next. The possession of economic power is surely becoming a social liability and the changes applying to other specializations apply here with equal force. Certainly, the technically trained man may expect to respond to the rule that managers of industry become its ultimate owners. If he learns well and gains an outlook broad enough, his heritage is bound to be magnificent.



## The Association of Consulting Chemists and Chemical Engineers

THE Association of Consulting Chemists and Chemical Engineers, Inc., was organized in 1928 to promote the interests of those members of the chemical profession who are engaged in independent consulting and analytical practice. There was a need for such an organization, since none of the existing chemical societies afforded an opportunity for consultants to come together for the solution of their common problems. One of the first undertakings of the Association was to formulate a code of ethics. This code was recently revised with a view to clarifying and simplifying its provisions in the light of the six years' experience that have elapsed since it was first drafted.

The need for a national organization in this field is even greater now than it was when the Association was founded. The independent consultant and the private laboratory can afford to play a lone hand less than ever. It is only through some such organization that he can effectively combat encroachment on his proper sphere of activity by government bureaus, universities, and other institutions supported by public funds. Besides there is much constructive work which can be done. Small and moderate-sized business organizations can be told how they may keep ahead through technical control and research without prohibitive expense. Those organizations large enough to support their own laboratories can be shown the advantages of outside contacts. The field for technical audits can be stimulated through cooperative action. Product certification is another field which is practically undeveloped and is being studied by the Association with a view to determining what form of control is necessary for its healthy development.

The Association has members in the New York, Boston, Philadelphia, Chicago, St. Louis, and San Francisco districts. Most of its members have been drawn from New York, Boston, and Philadelphia. Although membership is by invitation, it is the policy of the Association to extend invitations to all chemists and chemical engineers engaged in independent practice whose qualifications are such that they would be acceptable for the highest grade of membership in the American Institute of Chemists or the American Institute of Chemical Engineers and whose personal and business reputation is in keeping with the standards of the Association.

The Association's purpose of drawing to itself a larger membership

has been frustrated in part by the depression, many of those invited having felt that under existing conditions the entrance fee and dues were more than they could afford. The Association has accumulated a fair-sized surplus and advantage has been taken of this to reduce the entrance fee. It is hoped that this will result in drawing in a number of men whose cooperation in the work of the Association is desired.

The Association's headquarters are at 50 East 41st Street, New York City. The officers are Thomas A. Wright, Lucius Pitkin, Inc., *President*; Frank G. Breyer, Singmaster & Breyer, *Vice-President*; Paul Mahler, *Secretary*; Alvin C. Purdy, Bull & Roberts, *Treasurer*; Robert T. Baldwin, *Executive Secretary*.

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### Chemist Wanted

Wanted: Research Chemist with Ph.D. degree or equivalent training, with sound experience in dyestuff chemistry, particularly the chemistry of vat dyes. Address, with full particulars, Box 4111, *THE CHEMIST*, 233 Broadway, New York City.

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### Microscope Wanted

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Florence E. Wall, F.A.I.C., spent November 18th-23rd at Atlanta, Ga., where, in addition to being the program director of a trade exposition and a daily speaker, she also found time to address the Women's Division of the Atlanta Chamber of Commerce on "Government Control of Cosmetics," and the student body of Agnes Scott College on "Professional Opportunities for Women in Science."

## What Is a Professional Chemist?

By Florence E. Wall, F.A.I.C.

Professional solidarity as exemplified by the American Institute of Chemists contemplates united effort for the benefit of the profession of Chemist on the part of Consultants, Professors, Teachers, and Chemists employed in the industries, whether as executives or otherwise.

**A**FTER a quarter-century of study, observation, and experience, it is no longer amusing to hear a person, when asked to define a chemist, facetiously answer, "Ask me something easy!" or "Ask me another!" Really, it is no joke. If a composite photograph could be made from suggested definitions, it would show a weird protean creature of only the foggiest delineation—something that should arouse even the most lethargic member of the American Institute of Chemists to do his bit toward clearing up the picture. For if the Institute is to be recognized as the official organization toward which members of other professions and the public at large should be taught to look for information on the professional side of chemistry, both its immediate future and its ultimate success are intimately dependent not only on the clearing up, of these hazy notions, but also on making up our individual and collective minds on just who and what the professional chemist really is.

The Institute defines a professional chemist as "a person qualified by education and experience to ascertain the facts of chemistry and interpret them so as to benefit humanity and accelerate progress." In separating the real chemists from those who only think they are chemists, the words on which the average person can be tripped are *qualified* and *interpret*. To lay minds, particularly to those that absorb most of their knowledge of science from modern advertising, a chemist is anyone in a white coat depicted amid a storecounter display of retorts, condensers, flasks, etc., who squints into a microscope, or gazes thoughtfully at a clouded test tube—in a word, anyone who uses the tools of chemistry. As to the qualifications which give that person the right to use the tools, or the mental equipment necessary to interpret the results obtained and to make his opinion of value; these, alas, are too often never questioned.

"Chemist" is a neat, handy word which fits nicely into a headline. Hence we see in our daily press such heads as:

**Lone Chemist Wrecks Plant  
One Dead, Six Hurt**

or

**Boy Chemist Seized as Thief  
by Police Seeing Green Mice**

These are only two items from my collection on "newspaper chemistry," and they would seem to indicate a need for a dependable clearing house for public relations on chemists and professional chemistry.

THOSE interested in popularizing the science of chemistry to children and lay persons of all ages and tendencies may be delighted to know that the subject of the second headline was a 19-year old boy—"an amateur chemist since he was twelve years old"—who was experimenting in the cellar of his home on a process for the manufacture of a lethal gas which he wanted to sell to the government and devoting his spare time to changing the color of mice by means of injections. The other worked alone in the attic of a vacant downtown building, puttering over the manufacture of a synthetic vanilla extract, behind the bombastic title of "The United States Standard Chemical Company." Added to this circumstantial evidence that a chemist must be a dangerous person to have around, is the further damaging evidence that during the late "noble experiment," he seemed to be any good fellow who kept liquor safe for his friends to drink; or at any time, a scurvy creature, whom one employs even while despising him, to analyze some other fellow's product and duplicate it.

Who can wonder that the average lay person's notion of a chemist is extremely vague? Where beyond this need our Institute members look for a good start in promulgating its principles both to the lay public and to other chemists who are not quite sure of what the American Institute of Chemists represents? The qualifications of the professional chemist are more than adequately set forth in the educational and experience requirements that the Institute exacts of its members. There is some place in the American Institute of Chemists for every man and woman who has had a sound chemical education in any approved college or university. The exact status of membership is determined by accumulated experience and by the way in which the chemical education is being utilized. The common denominator for professional chemistry

is, therefore, a sound chemical education; and anyone with such an education is potentially a professional chemist at the time of graduation from college, regardless of how completely he may lose that professional consciousness later through diversification of interests.

If, somewhere along the line, these potential professional chemists had become imbued with the idea that they were professional persons by virtue of what they had studied and what they knew, rather than by what they happened to be doing, we should doubtless see less evidence of an unfortunate inferiority complex among practicing chemists, who believe that an employed person is, *ipso facto*, not a professional person. Who tells them this? Surprising as it may seem, the loudest declaimers are their brother chemists, men with no more, if as much, education and training who, if they had not had the necessary initiative and capital to set themselves up in business, might (if lucky these days!) likewise be employed by some one else.

OF course we hear that "the ideal situation would be for all chemists to be independent professional practitioners, like the physicians and the lawyers." Perhaps this is true, but during the past five years of economic crisis many a physician and many a lawyer has devoutly wished that he were not quite so independent, and a little more sure of a steady income. Theoretically, physicians and lawyers are in business for themselves; actually, large numbers of them are in the employ of organizations and corporations. If there is any barrier between the two groups in either profession, an outsider sees little evidence of it, because their professional solidarity stems from their fundamental education and training. A physician, for instance, does not give up his title and prerogatives of "Doctor of Medicine" because he takes down his shingle to write or lecture, to hold a political office, to direct an organization or a library, or what-not, because his education has made him a potential practitioner of professional medicine, and he wants no one to forget it. As for whatever else he picks up that makes him useful elsewhere later, he knows that it is always additive to, never subtractive from, his basic education. He still thinks in terms of his common denominator.

Professional solidarity of this kind is the greatest need of chemists. To acquire it, they need a sharp re-orientation of their point of view, so that they can appraise themselves and their fellow chemists in the light of education and background—the professional standards—rather than that of practice and occupation—the standards of the trades. It was to help in that re-orientation, and to direct the aspirations of

those seeking a career in chemistry that the American Institute of Chemists was established twelve years ago. American chemistry was then, and still is, over-organized technically and under-organized professionally; but, given the cooperation and support of enough chemists with the right point of view, professional solidarity will soon bring about the accomplishment of the Institute's laudable aims and objectives.

WHERE are these recruits to be found? The United States Census for 1930 records nearly 60,000 persons, men and women, who seem to have had varied chemical training of sorts. Obviously, all these could not meet the education and experience requirements for membership in the Institute, but our saying so seems to have no restraining influence upon the opinions of many others, their own included.

For success in spreading its concept and definition of a professional chemist, the Institute should look first to the schools. Serious students of chemistry seem to be really interested in the basic idea of the American Institute of Chemists, but if their teachers are not themselves perfectly clear about it, how can we hope to foster student chapters, enlist the cooperation of the honorary chemical societies, and encourage Junior membership among young graduates? The example of the Washington Chapter, which proposes to present a Student Membership Medal to outstanding students of chemistry at local universities, deserves to be followed by other present and future chapters of the Institute.

The Institute needs large numbers of recruits among chemistry teachers in both high schools and colleges. But first, these teachers must be converted, individually and collectively, to the realization that if they have the common denominator of the basic chemical education, they should think of themselves as "*chemists* who are teaching." Their knowledge of pedagogy should be considered as additive to, not subtractive from—and certainly not completely canceling—their latent potentialities as professional chemists.

As for those in business or industry, it does seem too bad to hear one man say of another, "He used to be a chemist." Why must he be considered less a professional chemist because he has acquired enough collateral knowledge to become a valuable executive, with the privilege of resting his heels under a polished desk—instead of on the rungs of a laboratory stool? Remember the physicians! Economics, finance, writing ability, business administration, law, foreign affairs, and anything else that a chemist can utilize in making his place in the world are of value to him without detracting from his basic chemical education.



AS was so well said by a President of the Canadian Institute of Chemistry, in one of the finest addresses ever delivered before an Institute meeting:\*

"Chemistry is the science of materials. Once we have been trained in it we cannot toss it aside like an old coat; in fact we continually find its ever-increasing usefulness in fields outside of what has always been considered purely chemical work."

The fact that so many chemists have been able to make high places for themselves in so many fields is a tribute to the seemingly boundless possibilities of applied chemistry. To all these "emigrant chemists," membership in the American Institute of Chemists offers the opportunity to revive or stimulate professional consciousness by means of the common denominator.

I have often been asked, sometimes in patronizing good humor, sometimes in contempt, why I am so much interested in the Institute. My answer is always the same: because it offered me something that no other organization had to offer, when I needed it most—a status that was like firm ground under my feet whichever way I might turn. It showed me that my sound chemical education, which had been utilized in several years of the helter-skelter, pile-on-everything-you-can life of the average teacher in secondary schools, and the kaleidoscopic shiftings of industrial chemistry during and after the war, had given me the right to consider myself a professional chemist, even though at the time of my admission (November, 1923) I was an unfortunate and expatriated victim of the post-war depression.

If, during the past twenty years, I had had to change my professional point of view each time I undertook something different, I should have been "mentally cross-eyed" long ago; but knowing that mentally I have been and am a professional chemist, who just happened to be able to do these odd jobs as they came along, has a steadying influence.

"So then," jeer the deriders, "A professional chemist is just a state of mind?" Not at all! But if, according to the Institute's definition, "a professional chemist is a person qualified by education and experience to ascertain the facts of chemistry and interpret them so as to benefit humanity and accelerate progress," then the best means of becoming and remaining one seems to be to keep that chemical education as a firm background.

\* *Chemists and People*, by E. T. Sterne, F.C.I.C.; THE CHEMIST, May, 1931.

## Symposium on Cost Accounting

A group of papers presented at the meeting  
of Niagara Chapter A.I.C. at Buffalo, New York,  
on November 2, 1934.

### Sales Cost Accounting

By William L. Hyden, F.A.I.C.

VERY little has been written on this subject in textbooks on cost of selling or classification of such costs into definite headings. Sales costs have usually been charged to overhead, general burden, or administrative expense. A great deal of attention has been given to production costs but within the past ten years the sales costs have been receiving more consideration. The reason for this is that more manufacturers are now selling direct and less and less through jobbers or middlemen.

Direct selling is better than selling through jobbers for two reasons:

1. A jobber often handles competitive lines and is not so aggressive in selling a product as the manufacturer.
2. In many cases the jobber's profit can be eliminated, as in selling to large stores, mail order houses, etc.

Selling in general is also receiving more attention than formerly because it is recognized that *profits* depend upon the ability to market a product and to service it advantageously in the trade. A large volume of sales is of no benefit if the margin of profit is missing. A system of arriving at sales costs is therefore essential. There are certain principles and methods which should be ascertained and followed in direct selling. The elementary steps include:

1. Getting a reliable sales forecast.
2. Correlating production facilities with sales forecast.
3. Estimating sales costs on this volume in relation to production costs.

The production costs are arrived at by considering the cost of materials plus the cost of manufacturing, including equipment and all other items involved in manufacturing. To these must be added administrative costs, general burden and selling expense before one can obtain a reason-



able picture of net cost. With this information at hand, a selling figure can be set which will permit a profit to be made.

IT would be interesting to go into the methods of making forecasts but this would require more time than has been allotted to this topic. Suffice it to say that this is the job of the managers of the various departments. In sales a generally accepted method is to determine the potential in customer consumption in any given field and then to estimate the probable percentage of that potential which one can hope to sell with the sales coverage that is available and the quality of the product that is being marketed. The summation gives a starting point and the whole scheme is made flexible and operative by monthly and quarterly revisions.

The matter of setting up a sales price is much easier in a non-competitive field than in a competitive one. The reasons are obvious. In this case one needs to have the total production costs and total selling expense to arrive at a net cost figure. Such costs are of two general types:

1. Fixed costs (rent, depreciation, salaries of executives, taxes, etc.).
2. Flexible costs (supplies, wages of workers, interest, and dividends, etc.).

Having set a price, the amount may be lowered from time to time as the volume increases and the efficiency of the production and sales departments increases to lower the flexible costs. In the competitive field the going is more difficult. Here the product is "tailor made" to meet a definite fixed sales price. In this case the organization plays a very important part. With this very brief outline of how dependent the sales cost is on production cost, general burden and management expense, as well as the public demand and, sometimes, fixed sale price, we shall turn to the sales manager's job of computing and controlling direct selling costs.

Theoretically, at least, the line between manufacturing and selling is at the factory gate. The sales department is interested in the product only in its finished form, though sometimes packaging is included in sales functions. The sales expenses are incurred in:

1. Getting the order.
2. Delivering the goods.

Some companies charge advertising to sales, others to administrative costs. Such variable practices make impossible any definite statement

applicable to all sales departments. Actual selling costs on standard commodities are reported to range from 5% upward.

The usual sales activities apparently include:

1. Advertising.
2. Salesmen.
3. Clerical and warehousing.
4. Management and supervision.

Advertising is an intricate and costly item. However, it plays an important rôle in selling. A product is sold only by personal contact or by advertising. Personal contact sells to the individual—advertising sells to the masses.

The cost connected with salesmen includes their expenses and salaries and/or commissions. Handling costs are involved in packaging, shipping, billing, collecting, and various sundry items down to bad debts. Management and supervisory expenses represent the only so-called fixed expense. It is quite evident, therefore, that the sales manager has a complicated job to ascertain sales costs accurately.

In summing up this matter of sales costs, I would like very much to be able to answer such questions as:

1. What percentage of sales prices can be used for advertising?
2. What is the proper relation of selling cost to production cost?
3. What additional price can be charged for extra quality?
4. Can there be a uniform and satisfactory method for setting up a margin of profit?

THE practices and conditions are too variable to give precise answers to these definite questions. I, therefore, must content myself with the sketchy outline of the points involved to arrive at the functions of a sales department and to show how the expenses can be assigned to certain specific activities. The first requisite is to keep the proper balance between volume of sales and economic production possibilities. A great many industries could increase their volume of sales by spending more money in sales campaigns. But increased sales are desired only when a profit is realized. Production costs are easier to calculate than sales costs, but the sales cost per dollar of product sold can be computed within fairly close limits. The combination of the two goes a long way to determine whether a business is profitable or not.

To arrive at the cost of sales, one must discard flat percentage rates between selling cost and amount of money brought in from sales. The

territories served with all their fluctuating conditions make such accounting of little value. The real way to accomplish this is by sales analyses and reports. These analyses simply include:

1. Salesmen's direct expense.
2. Special advertising.
3. General office and managing expenses.

Many companies specify quotas for each territory against which the salesman pits his performance. This method provides a measure of his efficiency. Study of the report of his expenses permits a definite cost to be calculated. Overhead may be charged to him in the ratio of his actual sales but generally a fairer method is to place the costs uniformly over the sales force, since supervision and general office expense is distributed about equally.

We reach the conclusion, therefore, that there is no fixed mathematical formula whereby one can arrive at proper sales costs. An accurate accounting system is required which is based on scientific and logical methods, including the essential steps of:

1. Field survey of potential sales.
2. Relation of actual economic factors to this potential.
3. Analysis of actual expense of selling and advertising in the territory covered.
4. Summation and treatment of these data for average cost.

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## Raw Materials—or Purchasing and Its Relation to Cost

By Charles F. Smith, F.A.I.C.

### I. General.

#### A. Conservative vs. Speculative Policies.

1. Conservative: Purchase when and as needed and commitments only against contracts sure of delivery.
2. Speculative: Quantity purchases and long term commitments based on estimates of future market trends. Also delay of purchases to take advantage of falling market. (Short selling.)

3. Middle course leaning toward conservatism recommended.
  - a. Increases profits without undue risk of loss.
  - b. Requires constant study of all factors affecting market.

B. Inventories: Idle Capital vs. Production Losses

1. Factors in maintaining minimum stocks:
  - a. Minimum quantity for low cost.
    1. Quantity prices.
    2. Lowest freight rates. (Freight charges often large proportion of material costs.)
    3. Cost of "shopping" and placing orders.
  - b. Time required for making delivery.
  - c. Storage facilities and perishability.
2. Dangers of too small inventories.
  - a. Production losses and increased expense of operation due to running out.
  - b. Possibilities of failure of source of supply or sudden increase in production.
3. Importance of control.
  - a. Perpetual inventory record.
  - b. Continual study of changes in conditions and their significance.
  - c. Follow-up of orders to insure delivery.
  - d. Frequent predictions or estimates by sales department valuable.

II. Rôle of the Chemist.

- A. Establishment and enforcement of specifications.
  1. Liberal as possible for protection of quality or supplier may demand premium.
  2. Aid Purchasing Agent in interpreting specifications or in purchasing without specifications.
  3. Discovery of new sources through reading and through contacts.
- B. Development of variations in process which will permit use of cheaper materials.
- C. Developing or recommending procedures by which company can manufacture own raw materials at a saving in cost.

## Manufacturing Costs

By William R. Sheridan

THE three elements necessary in a modern manufacturing plant are men, materials, and machines. The cost system for a plant will show the three corresponding elements of labor, material, and overhead. Each of these may be direct or indirect. For example, the labor of a person who actually works on the raw material and converts it into something else is direct labor, while the labor of one who does some other necessary task but does not transform the raw material is indirect labor. In the same way the cost of the raw material, which is transformed into finished product, is direct material cost; while other material which does not appear in the finished product is indirect material cost. In many cases, however, such material may appear as direct overhead. The expense incurred in providing the machinery, housing, heat, light, and other facilities for manufacturing is termed overhead. The terms direct and indirect are also applied to overhead, but here their meaning is a little different. Direct overhead is that which may be charged directly to some particular department or activity, such as repairs to a press; while all other overhead which cannot be thus directly charged, is indirect.

For purposes of accounting, a factory is divided into departments; these are usually, but need not be, in different rooms or buildings. Each department is further subdivided to obtain cost centers, in which one particular type of operation is done. By thus subdividing the process, the cost of each operation, and of the material as it passes through the plant, is accurately known. The direct labor cost is determined for each operation. Where straight piece-work rates are established this is determined once and for all by the time study, and the direct labor cost of each operation is always a definite amount. Where labor is paid by the hour, or by some bonus system depending on rate of production, the calculation of cost is somewhat more complicated, as it is subject to variation. It must then be determined for each period from the workers' time cards.

Direct material cost is determined from invoices. This is not quite as simple as it would at first appear, for deliveries of raw materials are made at different prices, and provision must be made for this. Two methods are used. In the "first-in first-out" method materials are charged at the oldest price until the number purchased at that price has

been used. Then the next price comes into effect. In the "moving-average" method a new average unit price is determined monthly for all stock on hand. This is computed by adding the total cost of the old stock on hand at the beginning of the month to the cost of the new deliveries, and dividing the sum by the total number of units. Naturally, of course, freight, purchasing, receiving, and storing expenses are added.

It is necessary to correct the stores records from time to time by taking a physical inventory. Storekeepers are apt to be generous in their measure, and items are sometimes taken from stores without the proper charge being made. As material is issued from stores and proceeds through the factory, the accounting department may keep track of it by the daily production records submitted by each department. However, this may be considered an unnecessary complication, and in such a case, the material is charged to a "Work in Process" account, which is relieved of it when the product is finished. Indirect material, such as small tools and supply items, is charged to the proper department through the requisitions issued to obtain it.

**O**VERHEAD charges include such items as rent, taxes, maintenance to equipment and buildings, salaries of superintendents and foremen, office and laboratory expense, and depreciation. Fixed overhead is that which does not change with the rate of operation of the factory, such as taxes, and manager's salary, and depreciation. Under variable overhead are included repairs, supervision, power, water, and so on. These expenses are more or less under control of the management, and may be kept to a reasonable amount if suitable effort is made. Overhead which can be charged directly to any department is so charged. The remaining overhead must be prorated among the departments on as fair a basis as can be. This may be on the productive capacity of each department, on the amount of direct labor, or on the space occupied.

It should be kept in mind that a cost accounting system is a means and not an end. It should enable the management to study the costs of the various operations and keep them within some reasonable or predetermined figure. Such figures are called standard or ideal costs, and are set up after a consideration of what may be expected. Once standard costs have been established, it is the responsibility of each foreman and superintendent to meet them, and an explanation is necessary whenever actual costs get out of line.

The method of arriving at standard costs must be considered. The normal or expected price of raw materials may be taken, together with the normal or average labor cost. Next the proper overhead is added. Since overhead is affected by amount of production, it is necessary to figure a standard cost for operation at various capacities. The way in which the amount of production affects overhead may be best shown by example. Suppose that a company produces 100,000 units a month at the following costs:

Total material costs	\$30,000
Total direct labor	20,000
Total overhead	50,000
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Total cost	\$100,000
Unit cost	\$1.00

Now suppose that due to an increase in orders 150,000 units are produced in some other month. Material and direct labor cost will increase in direct proportion to the number of units produced. Variable overhead will increase but fixed overhead will not, and the result may be:

Total material costs	\$45,000
Total direct labor	30,000
Total overhead	65,000
<hr/>	
Total cost	\$140,000
Unit cost	\$0.93 $\frac{1}{3}$

Thus the unit cost has decreased  $6\frac{2}{3}\%$  due only to increased volume. This shows clearly the saving which may be effected by large volume, and on the other hand, the loss involved in operating below normal capacity. It is evident, therefore, that it is necessary to figure a different standard cost for each capacity at which the factory may be expected to operate.

In the rubber industry this is avoided by not including overhead in the ideal cost. A new ideal cost is figured each month, using the actual prices of raw materials for that month. Direct labor is included, and this is based on piece-work rates. It might be mentioned here that there is a uniform accounting system throughout the rubber industry. This is required under the NRA to enable the checking of costs. Under this system overhead is divided into three classes, fixed, variable, and



auxiliary. The latter includes such items as accounting, time study, laboratory, and scheduling.

**F**OR monthly comparison purposes, and to show the progress or performance over a period of time, some plants go so far as to convert their products into equivalents. As an example, in the tire industry, one size tire is selected, and the ideal labor for that tire we will say is forty cents. This represents one equivalent. The labor for another size tire may be fifty cents. This will be 1.25 equivalents, and so on down the line. Each tire and each product is expressed in terms of equivalents. This enables comparisons to be made in spite of changes in the sizes of tires being built from week to week. Each equivalent ratio is multiplied by the number of units of that size produced, and the total equivalents divided into the total direct labor gives the equivalent labor cost. This figure should change only because of improvements in methods, or changes in labor base rates.

Finally, a cost accounting department, to be of real service, must prepare reports on manufacturing performance. Reports to foremen should reflect directly on the efficiency of each small unit. These must be issued promptly, so that any faults may be corrected at once. They will not show fixed or auxiliary overhead, as the foreman has no direct relation to these. For higher executives, cost reports are issued perhaps monthly, and, of course, include all phases of operation, but do not go into minute detail. These should show what a department or factory has done over a period of time, as compared with what it has accomplished last month or last year, or as compared with a trade association report for the industry as a whole.

## Laboratory Costs

By Albert L. Hall, F.A.I.C.

**M**ETHODS of determining costs in laboratories vary, but methods used in the determination of manufacturing costs may be applied to laboratory costing with satisfactory results. Assume the laboratory is part of a large organization manufacturing a variety of materials. The method used will apply equally to the small industrial plant, and also to the consulting profession. It will be necessary to divide the laboratory into two major units—testing, research and development, each under a capable director.



The first and probably the simplest unit is that of testing. Let us assume that the plant manufactures several products. For instance, in a paint and varnish factory many products such as enamels, paints, and varnish have to be carefully controlled. It is therefore desirable for efficiency in costing to separate the different control laboratories. The testing of raw materials should be a separate unit, and testing cost should be added to costs of materials.

In such a plant the sales department will want to know about competitors' products. Testing of such products may be conducted in the raw materials laboratory, or if the quantity of such work merits, it may be undertaken in a separate unit of the laboratory. It is also a good plan to set up a separate unit for physical testing and standardization work. The latter would include keeping equipment in first class order and be charged as overhead. We have, as the foregoing shows, set up separate units for work of different purposes, all chargeable to different units or departments.

The testing laboratory is not operated for profit, but as a service to different departments. Therefore, all cost is charged against these departments.

The general overhead, which includes such items as:

- Insurance.
- Rent and taxes.
- Direction and supervision salaries.
- Indirect salaries (stenographer, etc.).
- Light, heat, and power.
- Telephone, etc.

is chargeable against all the sub-divisions, in equal amount since a high salaried man uses the same amount of power and equipment as does one on a lower rate. To this is added the direct salaries, etc., for each sub-department. We have now obtained the cost of operating each department, and if a record of the number of tests is kept, we can obtain the cost per test. This net cost per test should be compared with that charged in outside laboratories. If the cost is higher, a reason should be obtained, and if it is impossible to lower it, then outside testing should be utilized.

**R**ESearch and development presents a more difficult problem. Should the research director be allotted a definite sum for each problem, or should he budget expenses, relying on his experience and the policies of the company? Probably the best solution is a combination

of the two. The director is held responsible for expense and should, therefore, have a budget for yearly expenditures. Such a budget should include:

1. Direct salaries.
2. Laboratory equipment.
3. Supplies.
4. Direction and supervision.
5. Indirect salaries and labor.
6. Light, heat, and power.
7. Telephone.
8. Printing and postage.
9. Traveling expenses.
10. Membership dues.
11. Insurance.
12. Rent and taxes.
13. General administrative overhead.
14. Sale plant expense.
15. Miscellaneous expense.

Before any problem is started certain benefits must be in sight, if it is to be completed successfully. The sales department must be able to set in writing the prospective market and its anticipated size. Against this should be set the probable cost of research and development. The larger the market, the more expense the project can withstand. However, in this respect, gradual steps are better than a complete program. It is better, at this point, to let the director have control of expenses. The problem is worked by gradual stages up to a semi-works plant. In order to keep a close check on the costs, a project number should be assigned and all requisitions for this project should be marked with this number and allowed by the director. Thus a definite cost can be placed against the project, also bearing in mind that it must share in the general overhead, which may vary in this department due to completion or inauguration of new projects.

Up to this point, a certain amount of control is to be had. When the project indicates a successful completion, it is generally carried over into a semi-works plant. Here it is difficult to estimate costs, and an appropriation is in order, which should be analyzed into manufacturing costs. These will, however, in the semi-works plant, be higher than actual expected manufacturing costs and such experimental cost data must be very complete in order to project a fair manufacturing cost.

For a more detailed explanation of laboratory cost-keeping refer to "The Technical Organization—Its Development and Administration," by Weiss and Downs (McGraw-Hill).

## Summary

By E. D. Lucker

IN approaching the problem of cost-keeping in connection with the manufacture of any product, the first question for consideration is whether the commodity is a staple or a specialty. Many of the luxuries of yesterday are the necessities of today. Is the field national and if so, what is its nature and stability? This country is well able to take care of foreign fields as well as domestic. Is there a foreign market for the product? Are there seasonal demands? What are the sales promotion costs?

Then comes consideration of plant costs and facilities. For instance, will there be any appreciable change in manufacturing conditions in the near future, particularly as to union relations, hours of labor, days of work, wage incentives? In all probability we shall be faced some day, not far distant, with such things as old age pensions, certainly unemployment insurance. The tendency in the future is not toward elimination of labor, but rather toward the control of labor. The goal which appears to be the aim of industry at the present time is not regulation from the outside, but self-control.

As to materials, there should be closer cooperation between laboratory and salesroom. Too many salesmen deal in superlatives. The salesmen should get their specific points from the laboratory men. Here it should be pointed out that the chemists can help materially by continuing their work in the direction of elimination of waste. It is better to pay attention to the margin of profit than to the volume of business. Many useless minor officials are being eliminated, nowadays, by big houses in the interests of efficiency, their places being taken over, to a certain extent at least, by trained foremen.

Attention must also be given to such items as the danger of being over-inventoried, the matter of taxes, and the payment of dividends. Budgets should and can be intelligently worked out with a limit of tolerance.

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## INSTITUTE NOTES

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## Council Meeting

The one hundred and sixteenth meeting of the Council of The American Institute of Chemists was held at The Chemists' Club, 52 East 41st Street, New York, N. Y., on Thursday, November 15, 1934, at 6:30 o'clock, P. M.

President M. L. Crossley presided.

The following Councilors and Officers were present: Messrs. R. A. Baker, F. G. Breyer, M. L. Crossley, A. J. Hill, F. Kenney, A. P. Lee, H. S. Neiman, W. T. Taggart, L. Van Doren, and Miss F. E. Wall.

The minutes of the previous meeting were approved.

The report of the Treasurer, showing a cash balance of \$1,477.71, and an excess of assets over liabilities of \$998.50, was accepted.

The Secretary read a letter from Dr. William J. Cotton accepting his appointment to the Membership Committee.

The Secretary read a letter from Dr. W. T. Read, Chairman of the Membership Committee, to the effect that a meeting of this committee would be held and that it would probably be able to present its report on December 10, 1934.

The matter of increasing the membership of the Institute was discussed at length and the various suggestions offered were submitted to the Membership Committee for its suggestions.

The following new members were elected:

FELLOW: Walter J. Murphy, *News Editor*,  
CHEMICAL INDUSTRIES, 25 Spruce St.,  
New York, N. Y.

JUNIOR: F. L. R. Sievenpiper was raised from Student member to Junior member.

Miss Wall reported progress for the Committee on Chapter Medals for students. Mr. Lee reported as Editor of THE CHEMIST. The Secretary was requested to write the Chapters to send the editor reports of their various meetings as well as other items of interest.

The matter of the reduction of dues was discussed in detail and upon motion made and seconded, action thereon was postponed until the receipt of the report of the Membership Committee.

Mr. Breyer was appointed Chairman

of a Committee to outline suggestions for Institute representation at the coming Spring Meeting of the A. C. S. to be held in New York. A report was requested for the next meeting of the Council, Mr. Breyer being authorized to select the other members of this Committee.

The Secretary reported upon the present membership of the Institute.

There being no further business, adjournment was taken.

## Niagara Chapter

The 9th regular meeting of the Niagara Chapter of the American Institute of Chemists was held at the Hotel Touraine, Buffalo, New York, Friday evening, November 2, 1934. Dinner was served at 6:30 and the program began at 8 o'clock. Visitors included Dr. Carl Rasch and Mr. Theodore R. Milne. Mr. E. D. Lucker of Scoville, Wellington and Co. was the guest speaker.

The secretary reported the present status of the proposed licensing bill for chemists about to be presented to the Legislature of the State of New York. The secretary reported the transfer of Mr. B. C. French to the rolls of the Niagara Chapter.

The Chairman suggested the appointment of a committee to follow up the matter of licensing. So moved by W. A. Smith, seconded by W. L. Hyden. Carried unanimously. The Chairman appointed the secretary, H. W. Post, A. W. Burwell, M. C. Taylor and W. A. Smith as committee. This committee will keep itself informed of developments in this field through proper authorities of the legislature.

The Chairman appointed as a nominating committee for officers for next year, R. L. Perkins and W. B. Brown. It was suggested that ordinarily the Vice-chairman be advanced to the post of Chairman each year.

THE COMMITTEE ON PROFESSIONAL ETHICS: M. C. Taylor reported no activities necessary. THE WELFARE COMMITTEE: G. H. Cartledge absent. PUBLICITY COMMITTEE: A. L. Hall reported actively in contact with newspapers. MEMBERSHIP COMMITTEE: W. L. Hyden asked for more suggestions for visitors for the next meeting. COMMITTEE ON PROFESSIONAL EDUCATION: W. R. Sheridan is still working on the matter of secondary school education in Chemistry.

The program consisted of talks as follows: GENERAL SURVEY, A. J. Norton; SALES COST AND GENERAL OVERHEAD, W. L. Hyden; RAW MATERIALS, C. F. Smith; MANUFACTURING COSTS, W. R. Sheridan; LABORATORY COSTS, A. L. Hall, and A PROSPECTUS OF A PLANNED BUSINESS VENTURE IN THE FUTURE, by E. D. Lucker.

### Washington Chapter

The first meeting of the Washington, D. C., chapter of the American Institute of Chemists was held Friday, Nov. 9, 1934, in the Board Room of the Cosmos Club. It was a business meeting. The question of annual dues was discussed. The members unanimously approved lowering the dues to \$5. It is thought that such action would

greatly increase the membership, which is of very vital importance to the Institute at this time.

The question of licensing chemists was discussed, which the Washington Chapter favors in principle. No final action was taken and a more detailed discussion will take place at a future meeting.

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### Pennsylvania Chapter

The subject for the October meeting was "The Chemist in Public Service, Here and Abroad." Mr. Joseph E. Chapin, Director of the Chemistry Laboratory of the Philadelphia Navy Yard, spoke of the chemist in the U. S. Government Service, describing the scope of his activities in many branches of the service. Mr. Newitt discussed the chemist in Public Service in England,

telling of the powerful influence exerted by the British Institute of Chemistry both in the establishment of high professional and ethical standards for the chemist as well as in securing for him something like adequate compensation. This would seem to be a highly desirable goal for our American societies. These interesting addresses were followed by extended discussion.

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### Institute Activities as Translated from the Minutes

By Florence E. Wall, F.A.I.C.

WHAT concerns your Council most just now is the urgent need for members—many more members—and this is a matter that can be put squarely up to each member of the Institute, instead of leaving the enlisting of recruits to the Membership Committee. The best answer you can have for the inevitable question, "What will joining the Institute do for me?" is, "It gives you a chance to serve the *profession* of Chemistry." And it must be admitted that no other scientific or technical organization does just that. On that theme one can expand *ad lib.* If, as we believe, the profession of Chemistry comprises those who are by education and experience *qualified* to practice and interpret the science of chemistry,

then it is up to each one of those so qualified to seek every means to establish his or her professional status and its adequate recognition both by the other professional groups and by the public whom we all serve.

A powerful means of securing new members is by really telling Chemists about the Institute and its aims and objectives. Not so absurdly simple as it seems, that! Because it means stirring yourself up to go where other chemists go, talking to a lot of people, perhaps when you would much rather smoke or read—making a speech if necessary—and really rousing those who are ignorant or indifferent to a knowledge and appreciation of the Institute's place in human affairs. If

you can talk at all, make some dates to talk about the profession of chemistry at your local schools and colleges, to other professional groups, to the vocational guidance counselors (how they will welcome some good ideas on the professional opportunities for chemists!), and wherever else you can find the chance. In this way, with the expense of no more than some time and thought you can make a considerable dent in the general lack of understanding as to who and what is a chemist.

The collection of delinquent dues is a serious problem. Rather than burden the Secretary's office with voluminous correspondence, your Council thought it better to refer the names of delinquent members to the local chapters. Frequently it is necessary to refer individual names also to persons who can confer with the member. If you are so delegated, do please see the person and report either to the local chapter, or to Mr. Neiman. Without a report of any kind the Council does not know what action to take.

Much discussion has been given to the question of lowering the dues. Would this interest you? Do you think it would bring in more members? If so, please let the Council know your thoughts on the matter. But remember that to meet any kind of budget at all, we must have a much larger membership. So we complete the circle: Get more members! Another question that keeps us out late on Council meeting nights is that of licensing chemists. New York State has so often led the country in movements for special legislation that the New York Chapter has drafted a licensing bill for presentation in the next session of the State Legislature. When it is published, do speak up and give it your support, or else, some tangible reasons for your opposition!

The Institute luncheon meeting at

Cleveland was so successful that we hope such a meeting will become a standing feature of all future A. C. S. meetings. It is surprising how many members of the A. C. S. do not know what the Institute is all about, and that it meets a need that other technical and scientific societies cannot attempt to meet, according to their stated programs. This attitude is just another case of history repeating itself; the Institute of Chemistry of Great Britain and Ireland met the same situation in its early days, and seems to have overcome all obstacles successfully.

How about insignia? An able committee of the Council is giving this matter some serious thought, because it is considered desirable by many members to have a neat seal or other device to designate Institute members, for use on stationery, coat lapel, watch chain, etc. The committee in charge of designing a medal for the student membership awards (to be given by local chapters in neighboring colleges), thinks it would be well to use the same design on these medals. If we turn loose a commercial designer on such a problem it is practically impossible to keep him away from depicting retorts, fuming test tubes, and similar tools of the *service* of chemistry. If you have any good ideas on what will symbolize the profession of chemistry, please let us have them.

As a last word, please do not forget THE CHEMIST. The editor wants articles of interest on the professional problems of chemists; stories of chemists who do unusual things; personal notes about members (do tell us whenever you make one of those speeches we suggested); discussion of published articles; advertisements of services and things useful to chemists. In other words, as we have been telling you since we started to publish it, "THE CHEMIST is YOUR paper; MAKE it your paper."



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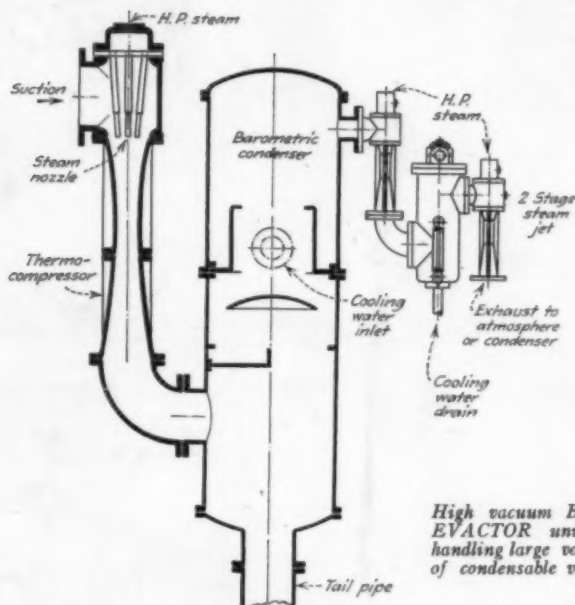
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